IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Toshiaki SASAKI, et al.

Serial No: 10/588,708

Confirmation No.: 2456

Filed: August 9, 2006

For: SUBSTRATE FOR THIN-FILM SOLAR CELL, METHOD FOR PRODUCING THE SAME, AND THIN-FILM SOLAR CELL EMPLOYING IT

Art Unit: 1795

Examiner: Shannon M. Gardner

APPEAL BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This is an Appeal from the Examiner's Final Rejection of claims 1-3, 5-7, and 9-11. The Final Rejection was issued on June 22, 2009. An Advisory Action was received dated September 24, 2009 rejecting claims 1-3, 5-7, and 9-11. A Notice of Appeal was filed with the Patent and Trademark Office on October 21, 2009.

REAL PARTY IN INTEREST

The real party in interest is Kaneka Corporation, Osaka, Japan.

RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

STATUS OF CLAIMS

Claims 1-3, 5-7, and 9-12 are pending. Claim 12 is withdrawn. This Appeal is directed to the final rejection of claims 1-3, 5-7, and 9-11, a copy of which appears as an Appendix to this Appeal Brief.

STATUS OF AMENDMENTS

An Amendment Under 37 C.F.R. § 1.116 was filed on August 20, 2009 in response to the Final Office Action dated June 22, 2009. Claim 8 was canceled and claim 1 was amended to incorporate the limitations of canceled claim 8 in that response. According to an Advisory Action which subsequently issued September 24, 2009, the amendment was entered and the request for reconsideration was considered, but the Applicant's arguments were deemed not persuasive.

EVIDENCE ENTERED BY EXAMINER AND RELIED UPON IN APPEAL

None (see Evidence Appendix)

SUMMARY OF CLAIMED SUBJECT MATTER

An object of the present invention is to effectively increase unevenness of a substrate for thin film solar cells, and to acquire efficient light trapping effect, to provide inexpensive substrates for thin film solar cells enabling improvement in

performance of the thin film solar cells, and a manufacturing method thereof. And another object of the present invention is to provide thin film solar cells having improved performance using the substrate. (Applicant's specification, at p. 8, lines 11-18).

It is an aspect of the present invention that with respect to the transparency of the material, or affinity with glass plate, silica micro-particles are preferable. In order to obtain 5 to 50 nm of a root-mean-square deviation of the surface of surface unevenness in the transparent foundation layer 112, a particle diameter of the micro-particles to be used is preferably not less than 10 and not more than 95 nm. In order to uniformly form the finest possible unevenness, the micro-particles have preferably a spherical shape. (Applicant's specification, at p. 20, lines 18-26).

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

There are two grounds of rejection on Appeal:

I. Whether the Final Office Action dated June 22, 2009 (the "Final Office Action") properly rejects claims 1-3, 5, 7, and 9-11 under 35 U.S.C. § 103(a) over Tawada (JP 2003243676; "Tawada") in view of Matsui (*Influence of substrate texture on microstructure and photovoltaic performance of thin film polycrystalline silicon solar cells*; "Matsui") and Robinson et al. (U.S. Patent Application Publication No. 20050238871; "Robinson"); and

II. Whether the Final Office Action properly rejects claim 6 under 35 U.S.C. § 103(a) over Tawada in view of Matsui, Robinson, and Oswald et al. (U.S. Patent Application Publication No. 20030116185; "Oswald").

ARGUMENT

I. The Rejection of Claims 1-3, 5, 7, and 9-11

Applicant respectfully submits that Tawada, Matsui, and Robinson cannot render claims 1-3, 5, 7, and 9-11 obvious, because the combination of references fails to teach or suggest "transparent micro-particles having an average particle diameter of not less than 10 nm and not more than 95 nm."

In KSR International Co. v. Teleflex Inc., 82 USPQ2d at 1391 (2007), the Supreme Court reaffirmed analyzing obviousness under 35 U.S.C 103(a) using the framework of Graham v. John Deere Co., 148 USPQ 459 (1966). The Graham factual inquires includes the following steps:

(A) Determining the scope and contents of the prior art;

(B) Ascertaining the differences between the prior art and the claims in issue;

(C) Resolving the level of ordinary skill in the pertinent art; and

(D) Evaluating evidence of secondary considerations.

The Office at p. 7, lines 8-14 of the Final Office Action dated June 22, 2009 states,

> "Regarding claims 8-11, Tawada in view of Matsui teach the transparent microparticles having an average diameter of 0.1 to 1.0 microns. However, it is known in the art to create a substrate containing silica microparticles (such as those used in modified Tawada) with particles having an average diameter of 5 to 25 nm, thus creating an improved surface of the substrate for thin film solar cells and other devices, as taught by Robinson (abstract, [0012]-[0018] and [0025])."

Applicant respectfully disagrees. As acknowledged by the Office, Tawada teaches an average diameter of 0.1 to 1.0 microns. Therefore, the entire range of Tawada is outside of the range of the present invention. Consequently, Tawada teaches away from the present invention. In determining the differences between the prior art and claimed invention, a prior art reference must be considered in its entirety.

> "A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984) (Claims were directed to a process of producing a porous article by expanding shaped, unsintered, highly crystalline poly(tetrafluoroethylene) (PTFE) by stretching said PTFE at a 10% per second rate to more than five times the original length. The prior art teachings with regard to unsintered PTFE indicated the material does not respond to conventional plastics processing, and the material should be stretched slowly. A reference teaching rapid stretching of conventional plastic polypropylene with reduced crystallinity combined with a reference teaching stretching unsintered PTFE would not suggest rapid stretching of highly crystalline PTFE, in light of the disclosures in the art that teach away from the invention, i.e., that the conventional polypropylene should have reduced crystallinity before stretching, and that PTFE should be stretched slowly.)." MPEP 2141.02(VI)

Therefore, without the benefit of the Applicant's disclosure, there would have been no incentive or reason for one of ordinary skill in the art to arrive at a transparent foundation layer that comprises transparent micro-particles having an average particle diameter of not more than 95 nm.

The Office at p. 8, lines 16-22 of the Final Office Action states (in Response to Arguments filed 3/10/2009),

> "Applicant argues that 'Tawada teaches away from the average diameter of less than 100 nm' (pp 8 of Arguments). The Examiner notes that though Robinson is relied upon to teach average diameters less than 100 nm. The teachings of Tawada provide the structural elements of the device but fail to disclose an average particle size of less than 100 nm. However, one of ordinary skill in the art would have looked to the prior art (i.e. Robinson) when determining the particle size in such a device."

In response, Applicant respectfully submits that the Office has failed to present an adequate showing as to why Tawada's teaching of an average diameter of 0.1 to 1.0 microns should be ignored in favor of Robinson's teaching of an average

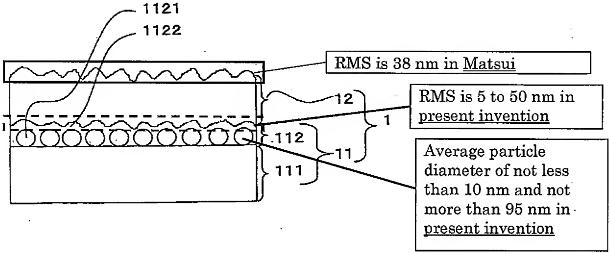
diameter of 5 to 25 nm, particularly, in view of the Office's acknowledgment that Tawada provides the structural elements of the device. Furthermore, as discussed above, references must be considered in their entirety including portions that would lead away from the claimed invention.

And since Robinson fails to teach or suggest the structural elements of the device, Applicant fails to see the rationale for using Robinson's average diameter of 5 to 25 nm.

In addition, Robinson employs colloidal silica having a particle size of about 5-25 nm so that surface smoothness is improved (see e.g., Robinson, paragraphs [0018] and [0025]). In contrast, a purpose of Tawada is to have an uneven surface to provide a larger light confinement (light trapping) effect. In this respect, Robinson and Tawada have opposite goals. Consequently, a person of ordinary skill in the art would not be motivated to combine these two references.

Furthermore, with respect to Matsui, the Office asserts that utilizing a textured substrate with a RMS roughness of 38 nm to improve the conversion efficiency is known (Final Office Action, at p. 4, lines 20-23). However, as discussed above, Matsui mentions the RMS value of 38 nm on the ZnO layer, not on the transparent foundation layer below ZnO layer as shown in the figure below. The surfaces disclosed in Matsui are different than the surfaces of the present invention. Stated differently, Matsui teaches the unevenness of the ZnO layer but is silent as to the unevenness of the transparent foundation layer.

Therefore, the combination of cited references fails to teach or suggest that "the transparent insulating substrate has a fine surface unevenness having a root-mean-square deviation of the surface of 5 to 50 nm in an interface by a side of the transparent electrode layer."



Furthermore, as described at p. 19, paragraph [0041] of Applicant's specification, the translucent micro-particles 1121 form unevenness in the translucent foundation layer 112, and can vary growth of a film of the transparent electrode layer 12 deposited thereon. That is, the unevenness of the transparent insulating substrate (translucent foundation layer) does not directly reflect the unevenness of the ZnO transparent electrode layer, but instead affects the growing state (form) of ZnO. Therefore, the optimal unevenness ranges of the insulate substrate (described in present invention) and the transparent electrode layer (described in Matsui) are not the same.

In addition, whether an uneven surface is in the light incident side or in the back side produces different technical effects. If the surface of the light incident side is uneven, the incident light is scattered when it transmits the uneven surface and thus a light confinement effect can be achieved. In contrast, as disclosed in Matsui, if the surface of the back side is uneven, the light is reflected at the uneven surface and then scattered. Therefore, the optimal unevenness ranges for the light incident side and for the back side cannot be the same.

The Office notes, at p. 8, lines 11-12 of the Final Office Action, that the instant claims do not require the placement of the transparent substrate on the front side or the backside of the solar cell. However, as discussed above, Matsui's reflective substrate is not a transparent insulating substrate, and cannot be used for the substrate on the light incident side. In contrast, the present invention requires that both the insulating substrate and the electrode layer be transparent, which means the adoption for the light incident side.

In view of the foregoing, Matsui does not render the feature "the transparent insulating substrate has a fine surface unevenness having a root-mean-square deviation of the surface of 5 to 50 nm in an interface by a side of the transparent electrode layer" obvious.

Moreover, the Office notes at p. 8, lines 13-15 of the Final Office Action, that the modified Tawada reference teaches the structural limitation of the instant claims. However, as evident from Figures 1 and 2 of Tawada, the transparent insulating substrate (1) is disposed on the light incident side, and therefore, Tawada's transparent substrate cannot be modified with Matsui's non-transparent reflective substrate.

In the Advisory Action dated September 24, 2009, the Office alleges that it is known in the art to create a substrate containing silica micro-particles having an average diameter of 5 to 25 nm, thus creating an improved flexible substrate surface with good high-temperature dimensional stability and high optical clarity, as taught by Robinson. However, as discussed in the Amendment dated March 10, 2009 in response to the Office Action dated December 1, 2008, Tawada teaches away from the average particle diameter of less than 100 nm (Tawada, paragraph [0028]). Specifically, Tawada teaches that a particle diameter of less than 0.1 μm (equivalent to 100 nm) or more than 1.0 μm (equivalent to 1000 nm) is not

preferable, because it reduces the effect of lengthening the light path, and the absorbance of the light will be deceased.

Consequently, should Tawada's invention be modified to have an average particle diameter of 5 to 25 nm, Tawada would be rendered unsatisfactory for its intended purpose.

The MPEP at 2143.01(V) states,

> "If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984) (Claimed device was a blood filter assembly for use during medical procedures wherein both the inlet and outlet for the blood were located at the bottom end of the filter assembly, and wherein a gas vent was present at the top of the filter assembly. The prior art reference taught a liquid strainer for removing dirt and water from gasoline and other light oils wherein the inlet and outlet were at the top of the device, and wherein a pet-cock (stopcock) was located at the bottom of the device for periodically removing the collected dirt and water. The reference further taught that the separation is assisted by gravity. The Board concluded the claims were *prima facie* obvious, reasoning that it would have been obvious to turn the reference device upside down. The court reversed, finding that if the prior art device was turned upside down it would be inoperable for its intended purpose because the gasoline to be filtered would be trapped at the top, the water and heavier oils sought to be separated would flow out of the outlet instead of the purified gasoline, and the screen would become clogged.)."

In view of the foregoing, a person of ordinary skill in the art would not be motivated to modify Tawada in the manner suggested by the Office.

In addition, in the Advisory Action dated September 24, 2009, the Office alleges that Tawada teaches a "general range for the average diameter of his micro-particles". However, as discussed above, the diameter of 0.1 to 1 μm in Tawada is more than a mere general range, but is instead an essential feature of Tawada.

In conclusion, claims 1-3, 5, 7, and 9-11 are submitted to clearly distinguish patentably over Tawada, Matsui, and Robinson, because the cited references fail to teach or suggest each and every claim limitation. Applicant respectfully requests that the final rejection of the claims be reversed and claims 1-3, 5, 7, and 9-11 be determined to be allowable.

II. <u>The Rejection of Claim 6</u>

Applicant respectfully submits that Tawada, Matsui, Robinson, and Oswald cannot render claim 6 obvious, because the combination of references fails to teach or suggest "transparent micro-particles having an average particle diameter of not less than 10 nm and not more than 95 nm."

As discussed above, Tawada, Matsui, and Robinson fail to teach or suggest this limitation. Oswald cannot remedy the defect of Tawada, Matsui, and Robinson and is not relied upon by the Office for such. Instead, the Office cites Oswald for teaching that it is known in the art to introduce isolation grooves/gaps into the back electrode and photoelectric layers of a photoelectric device to separate and electrically isolate adjacent back electrodes; and for teaching a later series connection of the separated photoelectric conversion cells, requiring connection grooves.

In conclusion, claim 6 is submitted to clearly distinguish patentably over Tawada, Matsui, Robinson, and Oswald, because the cited references fail to teach or suggest each and every claim limitation. Applicant respectfully requests that the final rejection of the claim be reversed and claim 6 be determined to be allowable.

The present Brief is submitted along with an Appendix containing the appealed claims and the requisite brief fee.

Respectfully submitted,

HOGAN & HARTSON L.L.P.

Date: December 21, 2009

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APPENDIX: CLAIMS 1-3, 5-7, AND 9-11 ON APPEAL

1. A substrate for thin film solar cells consisting of a transparent insulating substrate, and a transparent electrode layer including at least zinc oxide deposited on the transparent insulating substrate,

wherein the transparent insulating substrate has a fine surface unevenness having a root-mean-square deviation of the surface of 5 to 50 nm in an interface by a side of the transparent electrode layer, and

a projected area consists of a curved surface,

wherein the transparent insulating substrate consists of stacked layer of a transparent base material having a smooth surface, and a transparent foundation layer, and the transparent foundation layer comprises transparent micro-particles having an average particle diameter of not less than 10 nm and not more than 95 nm, and a transparent binder.

2. The substrate for thin film solar cells according to Claim 1, wherein the transparent electrode layer has a film thickness of not less than 1 micrometer.

3. The substrate for thin film solar cells according to Claim 1, wherein a haze ratio measured as a ratio of a diffuse transmittance to a total transmittance using a C light source is not less than 20%.

5. A thin film solar cell comprising the substrate for thin film solar cells according to Claim 1.

6. An integrated type thin film solar cell, comprising the substrate for thin film solar cells according to Claim 1, and at least one crystalline photoelectric conversion unit layer and a back face electrode layer deposited on the transparent electrode layer, wherein the layers are further isolated by a plurality of isolation

grooves so as to form a plurality of photoelectric conversion cells, and the plurality of photoelectric conversion cells are mutually electrically connected in series via a plurality of connection grooves.

7. A method for manufacturing a substrate for thin film solar cells according to Claim 1, wherein the transparent electrode layer including at least zinc oxide are deposited at temperatures of the transparent insulating substrate of not less than 150 degrees C.

9. The substrate for thin film solar cells according to Claim 1, wherein the transparent foundation layer comprises transparent micro-particles having an average particle diameter of not more than 90 nm.

10. The substrate for thin film solar cells according to Claim 1, wherein the transparent foundation layer comprises transparent micro-particles having an average particle diameter of not more than 80 nm.

11. The substrate for thin film solar cells according to Claim 1, wherein the transparent foundation layer comprises transparent micro-particles having an average particle diameter of not more than 70 nm.

EVIDENCE APPENDIX

None

RELATED PROCEEDINGS APPENDIX

None